PATENT SPECIFICATION (11) 1 513 877

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(31) Convention Application No. 7 223/74 (32) Filed 9 Sept. 1974 in
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(54) IMPROVEMENTS IN OR RELATING TO ENDLESS CHAIN CONVEYORS

(71) We, "CONPROJECT" HANDELSVERTRETUNG UND TECHNISCHES BURO FUR MASCHINENBAU FRANTL & Co. OHG, an Austrian Offenehandelsgesellshaft, of 33 Laudongasse, 1080 Vienna, Austria, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following

tween pairs of guide rails which are arcuate in direction changing zones, that the load-bearing devices, which are pivotally connected to the supports, are always maintained in a horizontal orientation.

Hitherto, it has been accepted that a chain conveyor of this kind could not be so constructed that the load-bearing devices could be maintained exactly in a horizontal orientation in direction changing zones. In one previously proposed construction of this kind, it was also found that especially in the zone of the apices of the path of the load-bearing devices, the guiding forces are applied to the load-bearing devices at unfavourable angles, resulting in jamming and heavy wear in the direction changing zones. For this reason it was considered necessary to use gear wheels in order to control the movement of those supports that are not connected to the chains, in the direction changing zones (see Austrian Patent No. 311 247).

According to the invention there is provided an endless chain conveyor, including two chains which extend parallel to each other in respective vertical planes and which each transport a support in the form of a main rocking plate for each of a plurality of load-bearing devices, and at least one further support in the form of a stabilizing rocking plate provided on a longitudinal edge of each of the load bear-

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means which prevent relative pivoting movement, to that one of the main rocking plates that is provided on the opposite longitudinal edge of the load-bearing device to the edge on which the stabilizing rocking plate is provided.

Thus the invention proceeds from the realisation that it is possible to guide the stabilizing rocking plates which are not connected to the chains even in the direction changing zones without having to use expensive and trouble-prone deflection mechanisms.

By "rocking plate" is meant any support element that distributes forces emanating from the pivot bearing of the load-bearing device to two spaced supporting points.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:—

Figures 1 and 2 are respectively a perspective view and a schematic plan view of

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(54) IMPROVEMENTS IN OR RELATING TO ENDLESS CHAIN CONVEYORS

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The invention relates to endless chain conveyors.

An endless chain conveyor, for example for conveying motor cars, may include two chains which extend parallel to each other in respective vertical planes and which each transport a support for each of a plurality of load-bearing devices, *e.g.* pallets, at least one further support being provided at an edge of each of the load-bearing device, and all the supports being so guided, by means of rollers running between pairs of guide rails which are arcuate in direction changing zones, that the load-bearing devices, which are pivotally connected to the supports, are always maintained in a horizontal orientation.

Hitherto, it has been accepted that a chain conveyor of this kind could not be so constructed that the load-bearing devices could be maintained exactly in a horizontal orientation in direction changing zones. In one previously proposed construction of this kind, it was also found that especially in the zone of the apices of the path of the load-bearing devices, the guiding forces are applied to the load-bearing devices at unfavourable angles, resulting in jamming and heavy wear in the direction changing zones. For this reason it was considered necessary to use gear wheels in order to control the movement of those supports that are not connected to the chains, in the direction changing zones (see Austrian Patent No. 311 247).

According to the invention there is provided an endless chain conveyor, including two chains which extend parallel to each other in respective vertical planes and which each transport a support in the form of a main rocking plate for each of a plurality of load-bearing devices, and at least one further support in the form of a stabilizing rocking plate provided on a longitudinal edge of each of the load-bearing devices, all the rocking plates being so guided, by means of rollers running between pairs of guide rails which are arcuate in direction changing zones, that the load-bearing devices, which are pivotally connected to the rocking plates, are always maintained in a horizontal orientation, each rocking plate being carried by rollers spaced from each other in the conveying direction and the or each stabilizing rocking plate not being connected with one of the chains but being positively coupled, by means which prevent relative pivoting movement, to that one of the main rocking plates that is provided on the opposite longitudinal edge of the load-bearing device to the edge on which the stabilizing rocking plate is provided.

Thus the invention proceeds from the realisation that it is possible to guide the stabilizing rocking plates which are not connected to the chains even in the direction changing zones without having to use expensive and trouble-prone deflection mechanisms.

By "rocking plate" is meant any support element that distributes forces emanating from the pivot bearing of the load-bearing device to two spaced supporting points.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:—

Figures 1 and 2 are respectively a perspective view and a schematic plan view of

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a first embodiment of an endless chain conveyor according to the invention;

Figure 3 is a schematic side elevation of a support in a direction changing zone of the conveyor of Figures 1 and 2; and

Figures 4 and 5 correspond to Figures 1 and 2 but show another embodiment of an endless chain conveyor according to the invention.

Referring to Figures 1 to 3, each of a plurality of load-bearing devices in the form of pallets 1, (only one of which is shown) is supported on two rocking plates 3 that are off-set from one another on opposite sides of the pallet 1 and each provided with two rollers 2, so disposed that the rocking plates 3 are able to swing about their bearings. The rocking plates 3, which will be referred to hereinafter as main rocking plates 3, are each connected to a respective adjacent movable chain 4. The chains 4 pass around synchronously driven direction changing chain wheels 5 and by means of dogs 6, guided in longitudinal slots in the main rocking plates 3, pull the pallets along and lift them in one direction changing zone and lower them in the other direction changing zone. The chains 4 could alternatively engage the spindle of one of the rollers 2. Each empty pallet 1 is preferably so balanced on the two rocking plates 3 that it is unstable over the theoretical pivotal axis *s* (Figure 2) which connects the two main rocking plates 3.

In order to stabilize the pallet 1 itself as well as the loads resting thereon, one or two stabilizing rocking plates 7 are provided, the or each of these being disposed coaxially with a or a respective main rocker plate 3 on the other side of the pallet 1.

Each stabilizing rocking plate 7 is connected to its associated main rocking plate 3 on the other side of the pallet by means of a torsionally rigid shaft 8 in such a way that the two rocking plates can only turn together and only to a similar extent around their bearings. The connection to prevent relative pivoting movement of a main rocking plate 3 and an associated rocking plate 7 could alternatively be effected in some other way, so that the coaxial arrangement of the two rocking plates 3 and 7 is not absolutely necessary. The rollers 2 of each main rocking plate 3 as well as rollers 9 of each stabilizing rocking plate 7 require their own guide rails which are preferably formed throughout by continuous pairs of rails but which in the direction changing zones and when only one stabilizing rocking plate 7 is provided, of necessity must take the form of a pair of guide rails. Thus there is a rail 10 above the rollers 2 and a rail 11 below the rollers 2, these upper and lower rails being inter-connected by inner arcuate sections 12 and outer arcuate sections 13 in the zones of change-over from the upper to the lower planes of travel. The pairs of rails is necessary in these zones because pressure caused by the rollers can occur in both directions.

Theoretically, two juxtaposed endless lengths of rail, which are spaced from one another by a distance equal to the distance between the points of rotation of a main rocking plate 3 and a stabilizing rocking plate 7 must be provided at each side of the pallet which is provided with one of the stabilizing rocking plates 7 in addition to one of the main rocking plates 3. That length of rail for the stabilizing rocking plate that lies closer to the pallet must, however, be interrupted at those points where it is crossed by the outer length of rail for the main rocking plate 3. In practice, for reasons of economy and space saving, the outer rail is usually left out and both lengths of rail are preferably arranged in one and the same plane. However at the points where the inner length of rail diverges from the outer one, a part of the outer rail must be retained as a bridge 14, 15, 16 so that those main rocking plates 3 alongside which is provided a stabilizing rocking plate 7, are provided with a second, outer, roller which is provided coaxial with and alongside each inner roller 2. The two additional rollers 17 are intended only for running over the bridges 14, 15, 16. Naturally it is alternatively possible to provide rollers for the main rocking plates which are wide enough to permit them to roll over the bridges 14, 15, 16.

Thus whereas the rail track for the main rocking plate 3 is continuous on that side that takes up the roller pressure, the rail track for the stabilizing rocking plate 7 is open where the rail track for the stabilizing rocking plate forms forks with the track for the main rocking plate. Due to the torsionally rigid shaft 8, which connects the stabilizing rocking plate 7 with the main rocking plate 3, the stabilizing rocking plate 7 remains in the required position without twisting even when only one of its two rollers bears on the rail, alternately with the other, when crossing the gaps in the rails. The distance *a* between the axes of the two rollers of each rocking plate (all the rocking plates are of similar form) is determined by the fact that at least one roller of the rocking plate located in the zone of a gap is guided by a pair of rails in the remaining zones where gaps occur in the lengths of rails. Furthermore the distance *a* is also determined by the fact that the two rollers of a rocking plate must not be able to slip vertically when they reach the

arc formed by the rails, even in the case where the open distance between the outer and the inner arcuate portions of the rails is greater than is required by the diameter of the rollers, *i.e.* the rollers are at points on the arc where they embrace a possibly large section of the arc. A further requirement for the distance between the two rollers of each rocking plate is determined by the fact that in the area of the upper and the lower gaps in the rails in the direction changing path of the rocking plates, the roller which is still enclosed by the rails should be supported in the vertical direction while the other passes a gap, there should not be so steep a gradient as to promote downward sliding. The distance between the two rollers is preferably large enough to extend over at least a 120° sector of the curve over which direction changing takes place.

The main rocking plates 3 and the stabilizing rocking plates 7 (since they have to execute the same movements together) are preferably so formed that their pivotal points and bearing points on the pallets are raised by the amount *h* above the points of engagement with the chains (see Figure 3) so that the pallets, which are moved at the same speed as the chains in the upper and lower horizontal planes, increase their speed in the first half of the direction changing curve due to the curve having a greater radius than the chain and the pallets therefore negotiate the curve more rapidly, in the last half of the curve the pallets then slow down until they are again at the speed of the chains. As a result of this, the distance between the upper and the lower paths of travel of the pallets is greater than the distance between the upper and the lower stretches of chain by an amount equal to twice the distance *h*. The greater the distance *h*, the higher each pallet can be loaded on its whole area without a pallet passing round the curve entering the load space of the next subjacent pallet and without its load space being encroached upon by the pallet ahead of it.

Without the increased height *h*, the distance between the pallets would have to be so great that the mutually facing ends of two adjacent pallets would lie vertically one below the other at the earliest when the leading pallet was disposed fully in the other plane This would lead to large unused spaces between the individual pallets and necessitate longer, *i.e.* less economic, and more expensive, conveyors for the same loading capacity.

The embodiment shown in Figures 4 and 5 has only one stabilizing rocking plate 7 which offers the considerable advantage that the pallet does not need to be substantially wider than the vehicles to be carried thereon. In this case a driver can without difficulty get out of a car, which had been driven onto the lower level, since opening of the doors is not inhibted by direction changing mechanisms.

The 3-point bearing of the pallets does, however, also offer considerable advantages for conveyors on which the cars are placed transverse to the conveying direction. Thus *e.g.* a 4-point bearing necessitates access ramps to the upper horizontal plane, a fact which may require considerable earth works or a correspondingly large ramp. If one of the stabilizing rocking plates is omitted it is possible with transverse conveyors also to have the access in the lower level, *i.e.* in the lower half of the direction changing zone which requires earth works or ramps much smaller than previously required.

WHAT WE CLAIM IS:—

1. An endless chain conveyor, including two chains which extend parallel to each other in respective vertical planes and which each transport a support in the form of a main rocking plate for each of a plurality of load-bearing devices, and at least one further support in the form of a stabilizing rocking plate provided on a longitudinal edge of each of the load-bearing devices, all the rocking plates being so guided, by means of rollers running between pairs of guide rails which are arcuate in direction changing zones, that the load-bearing devices, which are pivotally connected to the rocking plates, are always maintained in a horizontal orientation, each rocking plate being carried by rollers spaced from each other in the conveying direction and the or each stabilizing rocking plate not being connected with one of the chains but being positively coupled, by means which prevent relative pivoting movement, to that one of the main rocking plates that is provided on the opposite longitudinal edge of the load-bearing device to the edge on which the stabilizing rocking plate is provided.

2. An endless chain conveyor according to claim 1, in which the spacing between the rollers of each rocking plate is large enough to embrace at least a 120° arc of the direction changing zones

3. An endless chain conveyor according to claim 1 or claim 2, in which the pivot axis of each rocking plate is higher than the axis of its rollers by a distance which is equal to half the spacing between the axis of the rollers.

4. An endless chain conveyor according to any one of the previous claims, in which only one stabilizing rocking plate is provided, on only one of the longitudinal sides of each load-bearing device and the

rails comprise pairs of rails which take forces in the upward and downward directions.

5. An endless chain conveyor according to any one of the previous claims, in which all the main rocking plates which are provided with coaxially arranged pairs of rollers or with rollers which are wide enough to permit them to be supported on bridges that lie laterally outwardly of positions at which the rails are interrupted.

6. An endless chain conveyor substantially as hereinbefore described and illustrated with reference to Figures 1 to 3 or Figures 4 and 5 of the accompanying drawings.

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4 SHEETS

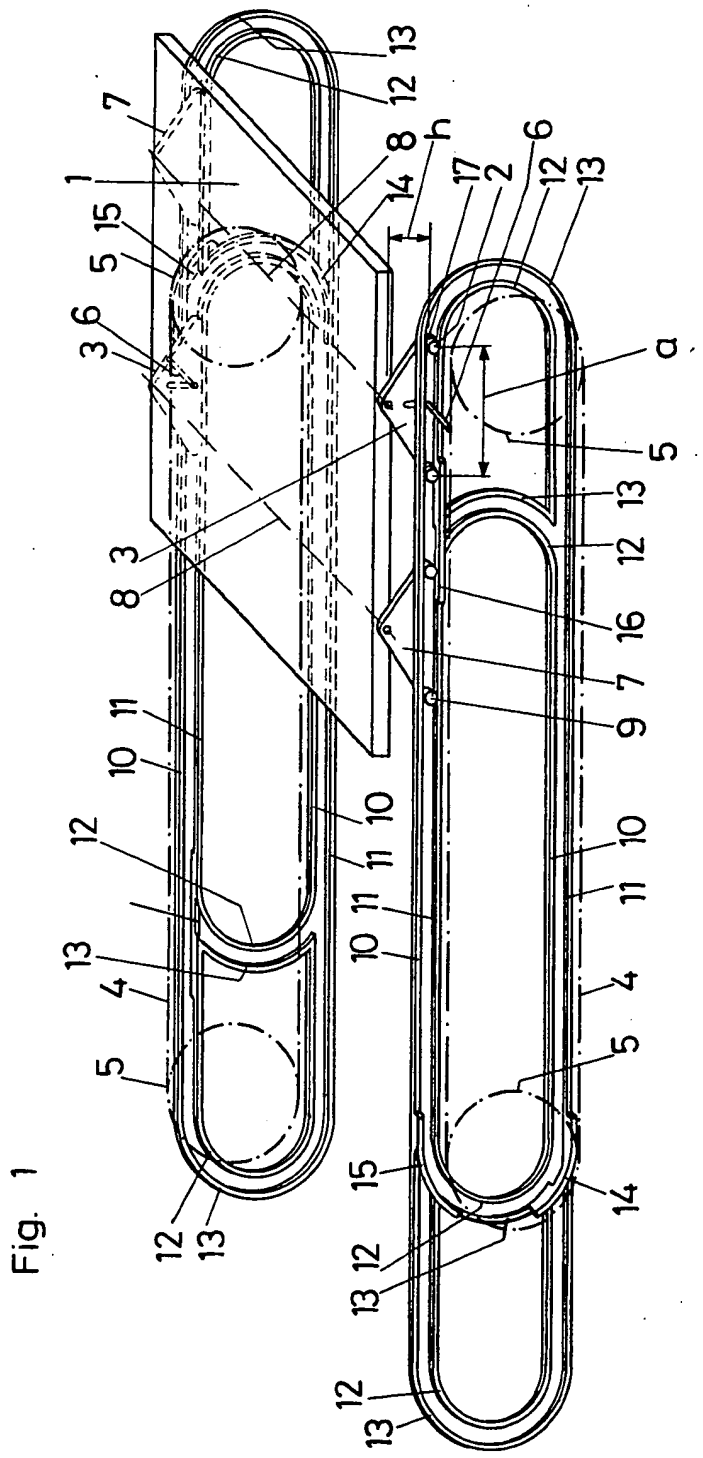


Fig. 1

Fig. 2

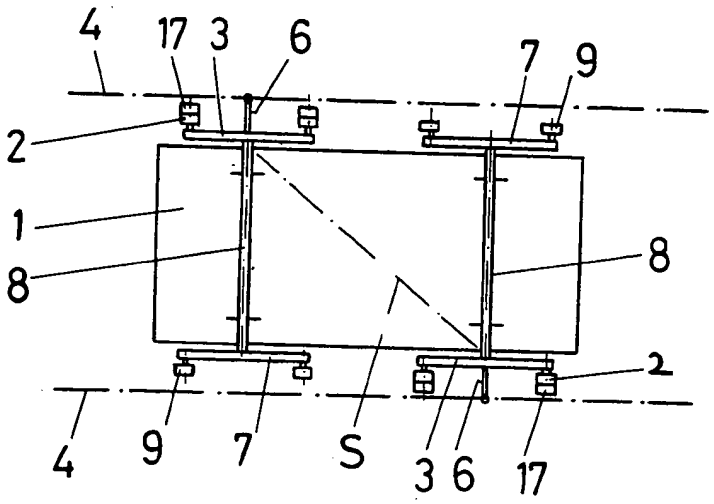
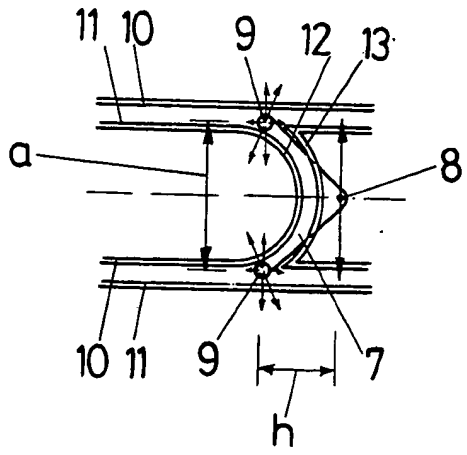


Fig. 3



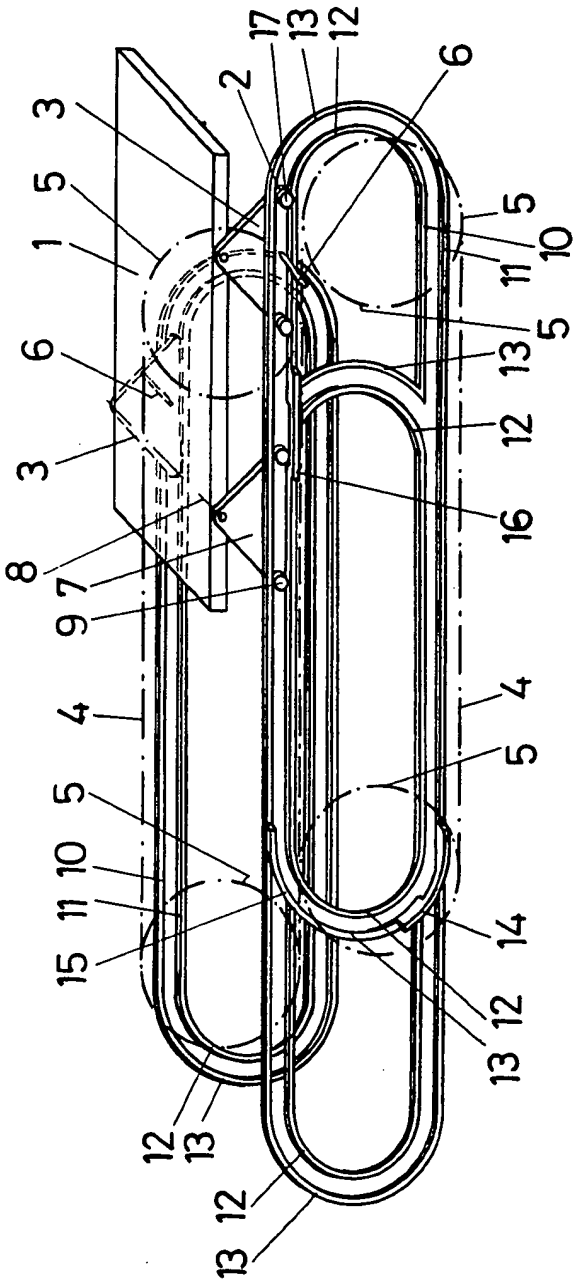

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Fig. 4

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COMPLETE SPECIFICATION

Fig. 5